

the practical bearings of the science, viz., the relations of the barometric depressions and storms of the Pacific States to the storms east of the Rocky Mountains. As regards the twenty-seven storms whose courses he has traced, it is probable that the great majority, if not the whole of them, were first formed over the Pacific Ocean. In each of the twenty-seven cases (with perhaps one single exception) the storm crossed the Rocky Mountains, and was thence tracked across the United States to the shores of the Atlantic, subject, however, in some cases to modification in its progress. It is scarcely possible to overrate the importance of these results in the practice of weather telegraphy and on questions affecting the general movements of the atmosphere. For we see here that an unbroken mountain-range of at least 6,000 feet in height does not stop the eastward progress of these barometric depressions and storms; neither do mountain-ranges of more than 10,000 feet in height, broken as in North America, present an insuperable obstacle to the onward course of these phenomena. The mountain-ranges between the Pacific and the Mississippi present obstructions to the formation of a system of winds of any great geographical extent; and hence, probably, barometric depressions are not so great over this uneven and broken region as over the vast plains of the Mississippi and eastern States, where there are no mountain barriers to interfere with the formation of a system of circulatory winds over areas 2,000 miles in diameter.

CHEMICAL NOTES

INFLUENCE OF TEMPERATURE ON THE ROTATORY POWER OF QUARTZ.—Following up the researches of Lang and Fizeau, Sohncké has found (*Ann. d. Phys. Chem.*, N.S. III. p. 516) that the increase in rotary power in quartz, with increase of temperature, is not directly proportional to the temperature, but is less at lower than at higher temperatures. For the crystal he experimented on he determined the following formula:—

$$\phi = \phi^{\circ} (1 + 0.0000999 t + 0.00000318 t^2),$$

where ϕ° = the rotatory power of the same crystal at 0° ; and he further found that the relative increase of power in the plane of polarisation was the same for all colours up to 170° . To see whether the octahedral system presented the same phenomena he also examined common salt, and obtained similar but more strongly-marked results.

CHANGE OF INDICES OF REFRACTION IN MIXTURES OF ISOMORPHOUS SALTS.—M. Dufet, in the *Comptes Rendus*, lxxxvi. 881, gives a most interesting account of some experiments he has carried out on the above subject, partly in continuation of such work as that of Senarmont, Topsoë, and Christiansen (*Ann. Chem. Pharm.*, 1874). Instead of examining simple isomorphous salts the author has taken mixtures containing varying quantities of magnesium and nickel sulphates, but of known composition. Working with such bodies he has determined that "the differences between the indices of a mixture of two isomorphous salts and those of the component salts are inversely proportional to the number of equivalents of the two salts entering into the mixture." In his calculation, M. Dufet has taken as an equivalent the number 111 or one equivalent of $\text{SO}_4 \cdot 7\text{HO}$. He considers the law of variation of the index as a consequence of Gladstone's law: the refractive energy $\frac{n-1}{D}$ of a mixture of two

bodies with no chemical action on one another, being the sum of the refractive energy of the component substances. According to M. Dufet, isomorphous salts crystallising together, form mixtures presenting analogies to a certain extent comparable with liquid mixtures, where the physical properties are the mean of those of

the components; this, however, is only true up to a certain point.

ALLOTROPIC MODIFICATION OF COPPER.—By the electrolysis of a solution of about 10 per cent. of copper acetate Schützenberger has obtained an allotropic variety of copper somewhat remarkable in its physical and chemical properties. During the electrolysis the surface of the negative platinum electrode which faces the positive copper electrode becomes covered with a layer of the allotropic modification of the metal, whilst the other side of the electrode is covered with a deposit of ordinary copper. The allotropic modification forms metallic glittering scales with roughened surfaces on the side next the solution; should the electrolysis be carried on long enough, beautiful tree-like forms are deposited on the edge of the negative electrode, which gradually ramify over to the positive electrode. The allotropic copper is less red than the ordinary variety, possesses surfaces without malleability, and can be reduced to an extremely fine powder. Its density, 8 to 8.2, is higher than that of the ordinary variety, which is about 6.9. It oxidises rapidly in the air, becoming at once iridescent, and finally of an indigo blue colour; when exposed to the air as a powder it becomes black, changing finally into the oxide. According to the author it becomes reconverted into the ordinary form of copper by heat, or exposure to certain chemical agents.

SACCHAROSE.—M. J. Motten has recently brought forward a paper, entitled a "Contribution to the History of Sugar (Saccharose)," in which the author discusses the action of light and of a temperature of 100° Cels. on solid and dissolved sugar, proving that the light alone does not invert dissolved sugar, and also that a temperature of 100° does not alter dry sugar. On the other hand solid sugar imperfectly dried, and dissolved sugar are altered under the influence of that temperature; oxygen is then absorbed, and carbonic acid evolved, but more slowly than it was often supposed.

HEAT EVOLVED IN THE FORMATION OF ISOMERIC BODIES.—M. Berthelot has given several communications to the Chemical Society of Paris, relating to the above subject. He finds that in general nitro compounds and isomeric nitric ethers appear to be formed with the disengagement of very unequal quantities of heat; the transformation of ethers into nitro compounds disengage approximately thirty heat units, at the same time undergoing increase of density and rise in the boiling point. In the case of metameric acids, as butyric, isobutyric, valerianic, &c., combining with the same base, his numbers show that the heat disengaged is precisely the same in the various cases which he describes. Approximately equal numbers are also obtained in the case of the chloro and bromo derivatives of these acids. There is very little difference also in the heat disengaged in the transformation of isomeric alcohols into isomeric aldehydes. The general results of his experiments, covering about thirty compounds, including alcohols, aldehydes, fatty acids, and their salts, chloro and bromo acids, &c., point to the conclusion that isomeric bodies having the same chemical function are formed with nearly identical disengagements of heat, their reciprocal metamorphosis disengaging very little heat. Finally, the same approximations exist in the formation of their isomeric derivatives.

CHEMICAL CHANGES TAKING PLACE DURING THE RIPENING OF GRAPES.—From experiments lately made on the transformations of the grape, and the exchanges between it and the surrounding atmosphere, MM. Saint Pierre and Magnien conclude that grapes at the time of their maturation liberate carbonic acid both in darkness and in light, the quantity produced being always superior to the quantity of oxygen consumed, if the experiment be long enough. This liberation occurs as well in an inert

gas as in air. Grapes are capable of absorbing or losing water when kept in a moist medium or in a dry medium. As maturation advances, the acids diminish and the sugar increases. The mechanism of maturation is stated to be this:—Acids and glucose are formed in the plant, and the sap conducts them to the grape; the acids are consumed in it, while the sugar is concentrated. When the maturation is very advanced, the sugar is consumed in its turn.

RIPENING OF GRAPES AFTER REMOVAL FROM THE VINE.—In the *Gazetta chimica Italiana*, vii. 517, some experiments by M. Pollacci are described, in which he finds that the process of ripening continues for a certain time after the grape has been removed from the parent plant. The bunches of fruit removed were, as far as possible, equally divided, and the quantity of glucose and acid determined in the freshly-gathered grapes, as also in portions kept in the shade for some ten or twelve days. In all the portions which had been kept, the glucose had increased, whilst the amount of acid had diminished, showing that a certain amount of ripening action had taken place; this action, however, ceases after a time, the ripening never attaining full maturity.

USE OF METHYL CHLORIDE FOR THE PRODUCTION OF LOW TEMPERATURES.—At a recent meeting of the French Physical Society, M. Vincent called attention to the use of chloride of methyl for production of low temperatures. It may be extracted in large quantities and cheaply from the products of beet-root molasses. It is normally gaseous, and liquefies under about four atmospheres pressure, when it may be conveniently carried about in iron or copper vessels, a store of cold at easy disposal. On opening a cock the liquid will flow out and give a bath at -23° , its boiling temperature under atmospheric pressure. If the vaporisation be intensified by a current of air, the temperature descends to about -55° . M. Vincent has arranged an apparatus for utilisation of such cold. He incloses two or three kilogrammes of liquid chloride of methyl in a double wall enveloping a bath of alcohol or chloride of calcium in solution, and protected exteriorly by an isolating layer of cork raspings. To obtain low temperatures, a cock is opened to allow communication of the double envelope (through a caoutchouc tube) with an air-pump.

FORMATION OF HYDROCARBONS BY THE ACTION OF WATER ON MANGANESE IRON ALLOYS CONTAINING CARBON.—Cloëz found that by acting on Spiegeleisen with dilute sulphuric acid bodies resembling the petroleum hydrocarbons were formed. On trying the action of pure water at 100° no results were obtained, while at 250° with super-heated steam, a certain action was perceived which increased with the temperature, being completed at a dark red. The hydrocarbons, however, were again decomposed. The same author has since tested a series of manganese alloys, and finds that the best results are obtained by means of one containing roughly Mn 85, Fe 6, C 3.5, Graphite 4, Si 1.1. Small portions of this, treated with boiling water, decomposed the latter with the evolution of hydrogen, oily drops being simultaneously formed, and the gas burning with a luminous flame showed the presence of hydrocarbons. Another alloy of nearly similar composition gave the following results: the flask contained slightly alkaline water with a mixture of iron and manganese oxides in suspension; the liquid hydrocarbons in the condenser were similar to those previously found, the gases also burning with luminous flames. He has thus shown that water alone at the proper temperature decomposes manganese iron alloys containing carbon.

ACTION OF BORON FLUORIDE ON CERTAIN CLASSES OF ORGANIC COMPOUNDS.—This body has been found by Fr. Landolph to combine in definite proportions, equivalent for equivalent, with certain classes of organic

bodies such as aldehydes, acetones, and also with camphor. For his experiments the particular substances examined were ethylic, valeric, and benzylic aldehydes, ordinary acetone, euodic aldehyde (oil of rue), and ordinary camphor. In all these cases considerable disengagement of heat was manifested in the combinations of the several substances. By the action of the fluoride on acetone two products are obtained, the one boiling between 130° – 140° , this being, according to the author, the most definite; another compound, however, exists which boils at a temperature of 160° – 170° . The first is a fluid of a syrupy consistence and yellow-green colour; it burns readily, giving a green flame, and is entirely decomposed by water. The compound, with ethylic aldehyde, ethylen fluoride, $C_2H_3BF_2$, undergoes decomposition when treated with water, into a body with a peculiar ethereal odour, the composition of which, the author thinks, may probably be C_2H_5FI .

GEOGRAPHICAL NOTES

In the just-published number of the Royal Geographical Society's *Proceedings* we find some useful remarks by Mr. F. Galton, on what has recently been done and what is further required for the advancement of geographical teaching. First and foremost, he says, is the publication of that excellent book by Prof. Huxley, "Physiography," which, starting from the simplest elements, led students steadily on to the higher conception of physical geography and the most recent discoveries in it. Next, Sir Walter Trevelyan, a former Secretary of the Society, had felt so much the necessity of a better form of text-book for geographical teaching that he had placed a handsome sum at the disposal of the Council to procure, if they were able to do so, the compilation of a really good county geography, to serve as an example for other similar works to be used in elementary schools. Turning to what is required in the future, Mr. Galton mentions that they have received a letter from a master of one of the great public schools, urging them to plan a system of diagrams explanatory of different physical features. His own opinion, Mr. Galton says, is that what is most urgently needed is some simple and well-methodised system of experiments, suited to illustrate lectures on the main features of physical geography. He has no doubt that an extension of the methods of illustrating the facts of physical geography—as used by Prof. Tyndall and Dr. Carpenter—on a small scale and on a lecture-room table, is perfectly feasible. Thus, as every thunder-shower shows in the streets the phenomena of erosion and deposition, he has no doubt that, on a lecture-table, with a can to supply water, and with a certain quantity of sand, gravel, and clay, all the main phenomena of river-action, such as the sifting of materials, the stratification of deposits, and the formation of deltas, might be successfully shown.

MEANS have recently been found, we learn from the *South Australian Register*, for still further increasing the usefulness of the Hon. (now Sir) T. Elder's camels on the far northern stations with which he is connected. The experiment of using them for draught purposes has been tried, and recently two teams of six camels drew loads of $5\frac{1}{2}$ tons each from Beltana to Port Augusta. The plan adopted is to yoke the animals together something after the manner in which bullocks are coupled, and one man only is required to manage each team. It has been found that the camels thrive well in the northern country; the number originally imported several years ago was about 100, of which the greater part died, as the land, by its comparative richness, presented too great a contrast to their native soil; there are now, however, about 400 of their descendants at Lake Hope, Umberatana, Beltana, and other stations in the far north, and the race seems to be thoroughly acclimatised. The camels have already been